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(54) Control information transmission apparatus for use in time division multiplex communication system.

(57) A control information transmission apparatus for use in time division multiplex communication systems for allocating the control information necessary for transmitting the data to a part of the user area between the communication apparatus (1, 2) connected to the time division multiplex highway (14, 15) comprises a control information transmission area variable setting means (11, 49) for selectively allocating control information in every time-slot in order to variably separate the control information transmission area from the user area so that the data can be transmitted at selected speeds.

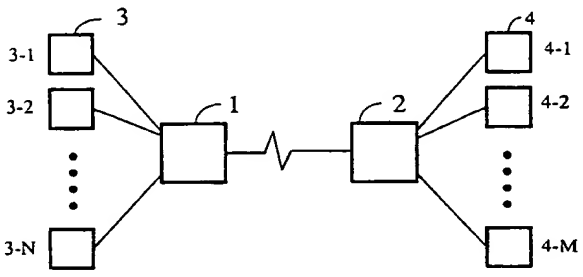

FIG. 1

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The invention relates to a control information transmission apparatus for transmitting control information required for data transmission in time division multiplex communication systems.

An apparatus which is capable of transmitting such control information is disclosed in the prior art publication JP-A-58-34634.

FIG. 7 is a block diagram of a conventional control information insertion and extraction circuit used in such time division multiplex communication systems. In FIG. 7, 51 is a central processing unit (CPU) for controlling the control information transmission apparatus. 52 is a serial interface for transmitting the control information. 53 is an inserting portion for inserting the transmitting control information. 54 is a sending side data transmission line for transmitting data. 55 is a receiving side data transmission line for receiving the data. 56 is an extracting portion for extracting receive control information. 57 is a serial interface for receiving the receive control information.

The operation of the conventional control information transmission apparatus is explained hereinafter. The CPU 51 controls both the transmitting and receive control information. The transmitting control information is output from the CPU 51 to the sending side data transmission line 54 through the serial interface 52 and the inserting portion 53. The receive control information received from the receiving side data transmission line 55 is extracted by the extracting portion 56 and output to the CPU 51 through the serial interface 57.

FIG. 8 shows a frame format construction of a $\underline{Y}$ interface primary group. The transmitting and receive control information are allocated to a fixed time-slot which is called a service channel. 58 is a frame having 24 channels. 59 is the head channel (CH 1) of the frame. 60 is the frame construction of head channel CH 1 having 8 bits in the channel.

61 is a fixed time-slot in which a service channel is allocated in each channel 59 of the frame 58. The CPU 51 extracts the control information from the fixed channel in the data signal received from the receiving side data transmission line 55, or inserts the control signal to be transmitted into the service channel and transmits it to the sending side data transmission line 54.

When the conventional control information insertion and extraction circuit is constructed as described above in such time division multiplex communication systems, there are problems caused by the fact that the transmission rate of the transmitting or receive control information is fixed. Also, since the time-slot where the control information is inserted is restricted, it is difficult to transmit a lot of control information during a short time.

Therefore, since a fixed channel for transmitting the control information is allocated in the conventional system and if a system requires the transmission of a lot of control information during a short time, the user area decreases and the system transmission efficiency decreases, too.

It is a primary object of the present invention to provide a control information transmission apparatus for use in time division multiplex communication systems which is capable of transmitting a lot of control information at a high speed during a short time, and realizing a high efficiency transmission by decreasing a loss of the main data transmitted by the user area of the frame channel.

It is another object of the present invention to provide a control information transmission apparatus for use in time division multiplex communication systems which is capable of transmitting a lot of remote loop back information or route changing system data at a high speed during a short time, and realizing a high efficiency transmission by decreasing a loss of the main data transmitted by the user area of the frame channel and which is also suitable for changing the route at a high speed in order to respond to a system fault.

A control information transmission apparatus of a first embodiment of the present invention for use in time division multiplex communication systems for allocating the control information necessary for transmitting the data to a part of the user area between the communication equipments connected by the time division multiplex highway comprises a control information transmission area variable setting means for selectively allocating control information in any time slot in order to variably separate the control information transmission area and the user area so that the data are transmitted at selected speeds.

In the control information transmission apparatus of a second embodiment of the present invention for use in time division multiplex communication systems, the control information transmission area corresponds to a test function setting transmission area in which the remote loop back information is allocated or a system switching transmission area in which the system data is allocated for changing the routing.

The invention will be further described by way of non-limitative examples of preferred embodiments with reference to the accompanying drawings, in which:

FIG. 1 shows a communication network embodying the present invention and connected to the time division multiplex highway of a $\underline{Y}$ interface primary group.

FIG. 2 is block diagram of a control information insertion and extraction circuit embodying the present invention for realizing the control information trans-

mission apparatus as used in time division multiplex communication systems.

FIG. 3 shows a frame format of the Y interface primary group of the control information transmission apparatus of the present invention as used in time division multiplex communication systems.

FIG. 4 shows a format construction in which the service channels are set in each channel corresponding to respective routing in accordance with the present invention.

FIG. 5 shows a construction for another communication system embodying the present invention.

FIG. 6 show a format construction of the service channel construction which is set when a fault occurred in the communication systems.

FIG. 7 is a block diagram of a conventional control information insertion and extraction circuit used in time division multiplex communication systems.

FIG. 8 shows a frame format construction of the Y interface primary group of the system of FIG. 7.

First Embodiment

The first embodiment of the present invention is explained hereinafter with reference to FIG. 1.

FIG. 1 shows a communication network embodying the present invention and connected to a time division multiplex highway of a Y interface primary group. In FIG. 1, 1 and 2 are communication apparatus connected to the time division multiplex highway of the Y interface primary group. 3 represents N terminal equipments 3-1,..., 3-N connected to the communication apparatus 1. 4 represents M terminal equipments 4-1,..., 4-M connected to the communication apparatus 2.

FIG. 2 is block diagram of a control information insertion and extraction circuit used in the communication apparatus 1 and the communication apparatus 2 for realizing the control information transmission apparatus of the present invention for time division multiplex communication systems.

In FIG. 2, 11 is a CPU for controlling the control information insertion and extraction circuit. 12 is a serial interface for transmitting the control information. 13 is an inserting portion for inserting the transmitting control information. 14 is a sending side data transmission line SD for transmitting data. 17 is a serial interface for receiving control information. 18 is a time-slot information register.

The inserting portion 13 comprises a time-slot counter 13a for counting time-slots for 24 channels from 1 to 192 by the means of a frame synchronous signal. The time-slot counter 13a outputs the counted values as time-slot address information.

The inserting portion 13 reads out the contents written in the time-slot information register 18 by the time-slot address information. Then, the inserting portion 13 outputs the transmitting control information received from the CPU 11 through the serial interface 12 to the sending side data transmission line 14 in response to the read out contents of the time-slot information register 18.

15 is a receiving side data transmission line RD for receiving data. 16 is an extracting portion for extracting receive control information. The extracting portion 16 comprises a time-slot counter 16a for counting time-slots for 24 channels from 1 to 192 by means of a the frame synchronous signal. The time-slot counter 16a outputs the counted values as time-slot address information.

The extracting portion 16 reads out the content written in the time-slot information register 18 by the time-slot address information. Then, the extracting portion 16 extracts the receive control information from the main data on the receiving side data transmission line 15 in response to the read out contents of the time-slot information register 18. The receive control information extracted by the extracting portion 16 is output to the CPU 11 through the serial interface 17.

Identification data which identify the control data or the main data is written into the time-slot information register 18 corresponding to the time-slot address information outputted from the time-slot counter 13a or the time-slot counter 16a. This identification data is written into the time-slot information register 18 in advance by the CPU 11.

As described above, the control information transmission apparatus comprises the CPU 11, the time-slot counter 13a, the time-slot counter 16a, the serial interface 12, the inserting portion 13, the sending side data transmission line 14, the receiving side data transmission line 15, the extracting portion 16, the serial interface 17, and the time-slot information register 18.

FIG. 3 shows the frame format of the Y interface primary group of the control information transmission apparatus of the first embodiment of the present invention as used in the time division multiplex communication systems. 21 is a frame constructed of 24 channels. 22 is the head channel (CH 1) of the frame 21, and 23 is a frame construction of the head channel CH 1 having 8 bits in the channel.

The operation of the first embodiment of the present invention is explained below, wherein the terminal equipment 3-1 is communicating with the

terminal equipment 4-17 and wherein the terminal equipment 3-1 is subsequently requested to communicate with another terminal equipment, e.g. terminal equipment 4-2.

The communication apparatus 1 and the communication apparatus 2 set a service channel in an unused channel of the user area. That is, each time-slot of the respective channel is selected for setting a control information area or a user area. This setting is executed by the CPU 11.

As a result, the service channel transmission area and the user channel transmission area are newly set for every time-slot in the frame. The control information (the information for changing the multiplex format) is transmitted at a high speed using the service channel transmission area. The CPU in the communication apparatus 1 and the CPU in the communication apparatus 2 change the multiplex format.

When the high speed transmission of the control information using the newly set service channel transmission area has been finished, the setting of the service channel transmission area and the user channel transmission area is released and returns to the former low speed service channel.

As describe above, since the service channel is set in any of the time-slots, the control information can be transmitted at a high speed so that the user transmitting area will not be lost. Accordingly, a dynamic routing is executed at a high speed in the first embodiment.

Second embodiment

A second embodiment of the present invention is explained hereinafter. The communication equipment and the control information insertion and extraction circuit of the second embodiment are the same as those of the first embodiment of FIG. 2.

FIG. 4 shows a format construction in which the service channels are set to each channel corresponding to respective routing in the second embodiment of the present invention.

In FIG. 4, 31 is a frame construction having 192 bits. 32 shows the head channel CH 1 corresponding to the first routing. 33 shows a channel construction of the head channel CH 1 having 8 bits. 34 is a time-slot in the channel CH 1. 35 is a service channel corresponding to the first routing having 8 kbps transmission capacity. 36 is a fourth channel CH 4 corresponding to the second routing. 38 shows a channel construction of the channel CH 4. 38 is a service channel corresponding to the second routing having 16 kbps transmission rate.

Since every time-slot can be set as a service channel transmission area, the service channel can be set without using any hardware switch for the multiple access used in the primary group interface of an integrated services digital network (ISDN).

Third embodiment

The third embodiment of the present invention is explained hereinafter.

The setting of the service channel of the third embodiment is explained for a case where a fault occurs in the communication system shown in FIG. 5.

FIG. 5 shows a construction of another communication system in which the third embodiment is applied. In FIG. 5, 39, 40 are relay equipments. 41, 42 are communication apparatus. The communication apparatus and the control information insertion and extraction circuit of the third embodiment are the same as those of the first embodiment of FIG. 2. 43 is a terminal equipment connected to the communication apparatus 41, and 44 a terminal equipment connected to the communication apparatus 42.

FIG. 6 shows the format construction of a service channel construction which is set when a fault occurs in the communication system. In FIG. 6, 45 is a frame construction having 192 bits. 46 shows a head channel CH 1. 47 shows a second channel CH 2. 48 is a time-slot in the head channel CH 1. 49 is a remote loop back setting area. The remote loop back setting area 49 is used in order to send a test pattern from the communication apparatus 41 or 42 to the relay equipment 39 and in order to execute the return test at the relay equipment 39, when the relay equipment 39 fails during the time where terminal equipment 43 and the terminal equipment 44 communicate through the communication apparatus 41, the relay equipment 39 and the communication apparatus 42. 50 is a program down load information transmission area in which the communication apparatus 41 and 42 alternatively download the control information in order to make another route which bypasses the failed route. The remote back area or program download information transmission area 50 is allocated for a time-slot in the channel.

In this case, the remote loop back setting area 49 and program download information transmission area 5O correspond to the service channel. The remote loop back setting area 49 and program download information transmission area 50 are set in many unused channels of the user area by the communication appatatus 41 and the communication apparatus 42. The program download information transmission area 5O is used for changing the route at a high speed in order to recover the fault system.

As described above, according to one of the embodiments, since the service channels for transmitting the continuous control information are set in

any time-slot, the control information insertion and extraction circuit can transmit a lot of control information at a high speed during a short time. The control information can also be transmitted at high efficiency with a low loss of the user transmitting area. Accordingly, a dynamic routing is executed at a high speed in the first embodiment.

According to the other embodiments, since the remote loop back information or the system data for changing the routing are allocated in the control transmission area, the route changing is executed at a high speed in order to recover the fault system.

Claims

1. A control information transmission apparatus for use in time division multiplex communication systems for allocating the control information necessary for transmitting data to a part of the user area between the communication apparatus (1, 2) connected to a time division multiplex highway (14, 15) comprising:
a control information transmission area variable setting means (11, 49) for allocating selectively control information in every time-slot in order to variably separate the control information transmission area from the user area so that the data are transmitted at selected speeds.

2. The apparatus according to claim 1,
wherein the control information transmission area corresponds to a test function setting transmission area in which the remote loop back information (49) is allocated or a system switching transmission area (39, 40) in which the system data is allocated, in order to change the routing.

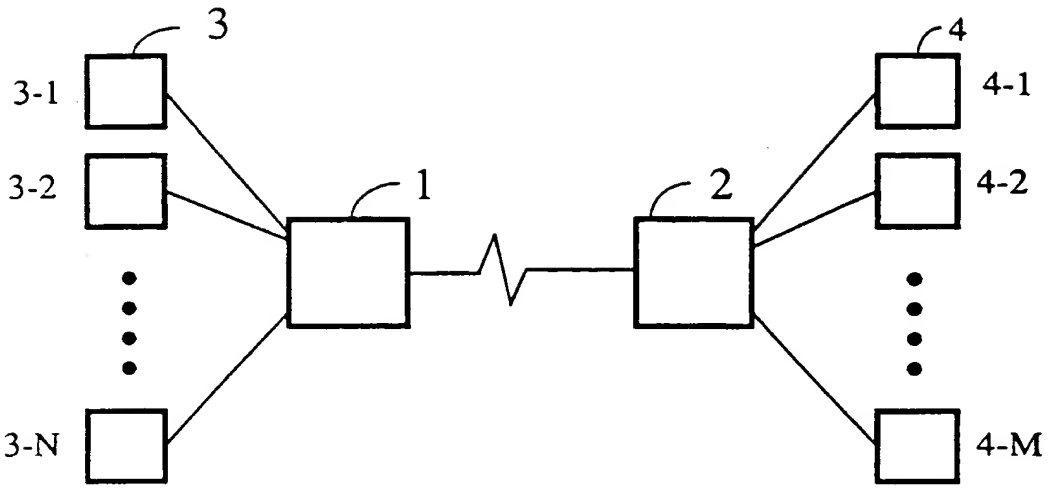

FIG. 1

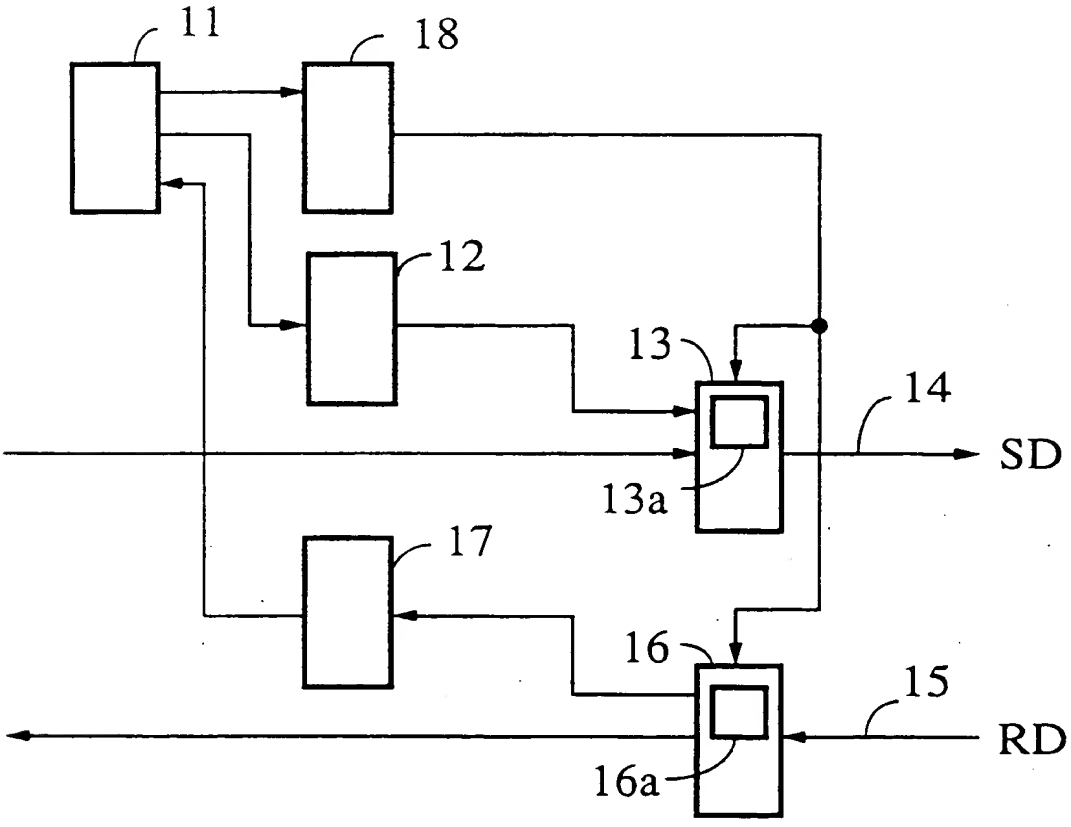

FIG. 2

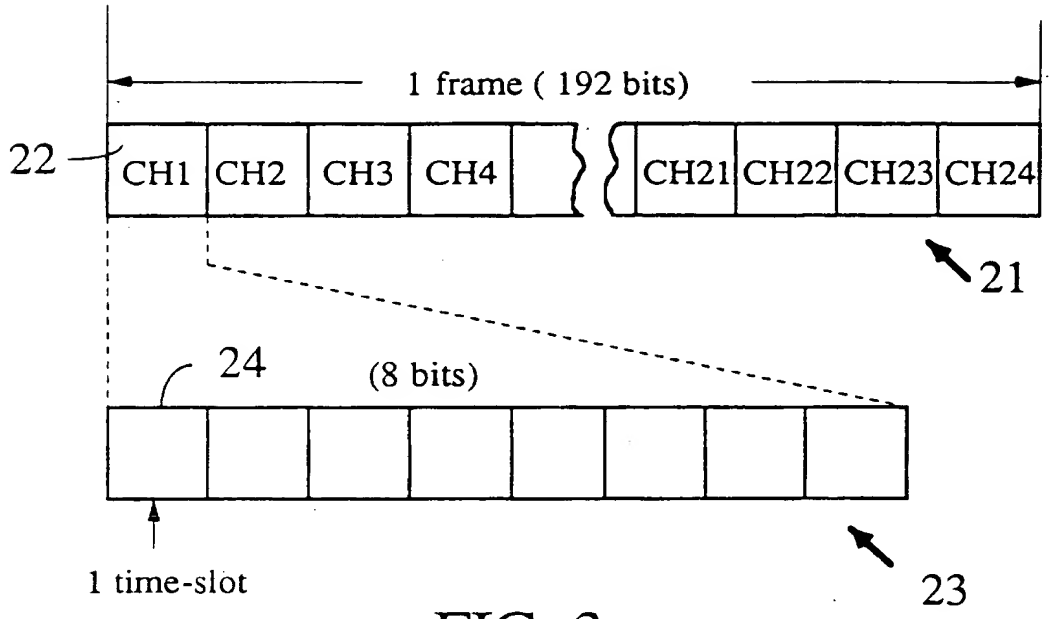
1 frame (192 bits)
22
CH1
CH2
CH3
CH4
CH21
CH22
CH23
CH24
21
24
(8 bits)
1 time-slot
23

FIG. 3

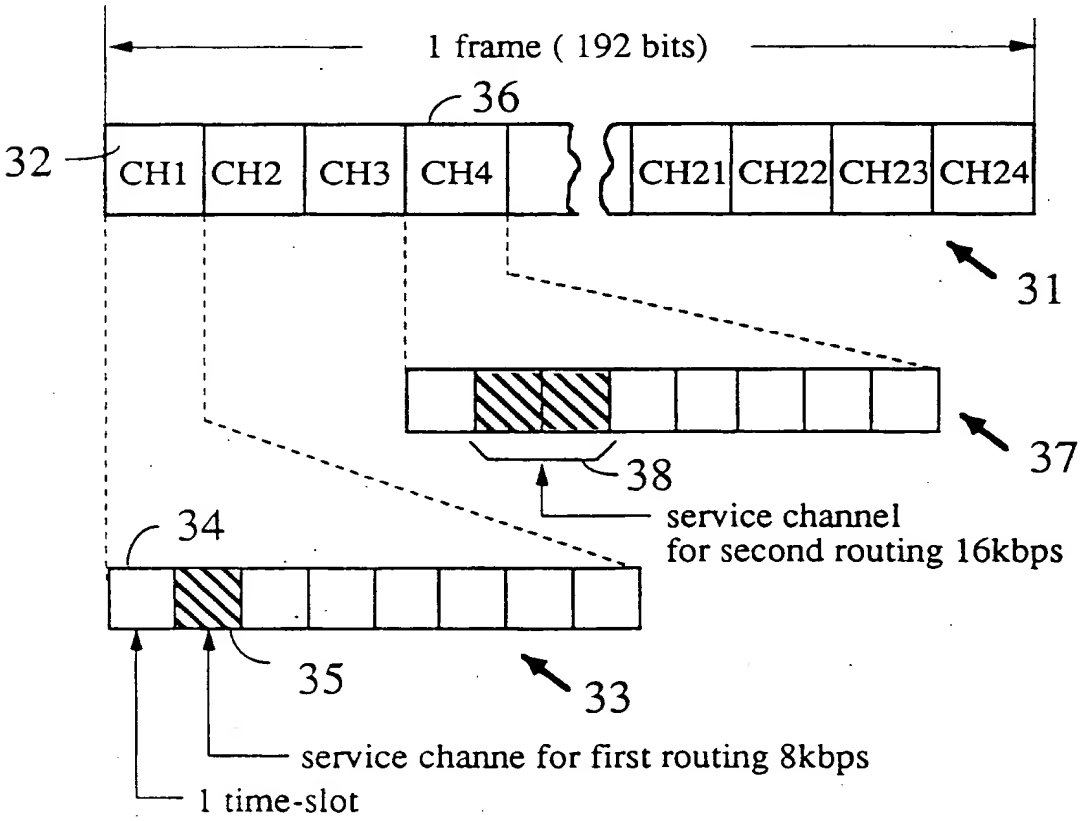
1 frame (192 bits)
36
32
CH1
CH2
CH3
CH4
CH21
CH22
CH23
CH24
31
37
38
service channel
for second routing 16kbps
34
35
33
service channe for first routing 8kbps
1 time-slot

FIG. 4

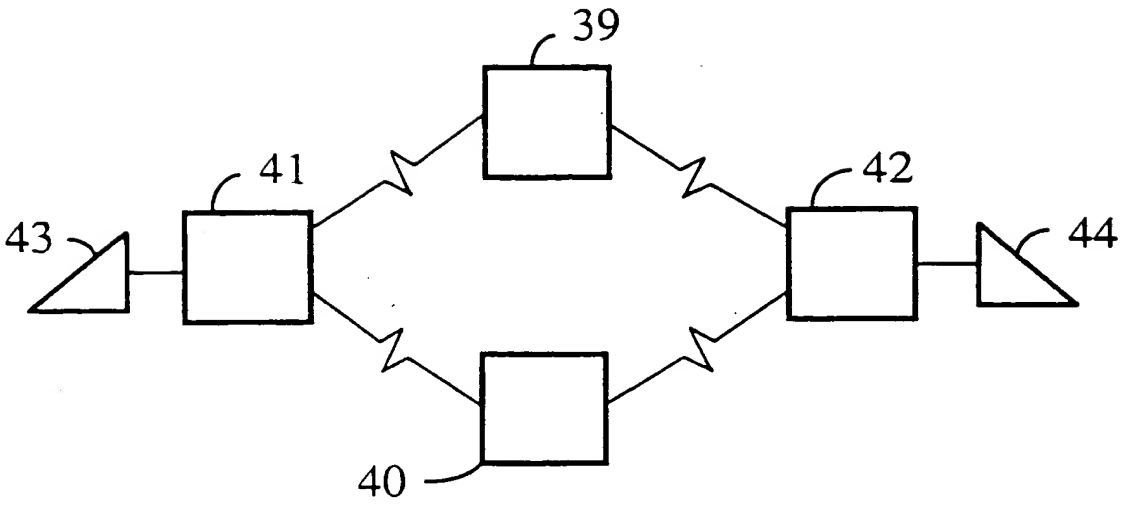
39
41
42
43
44
40

FIG. 5

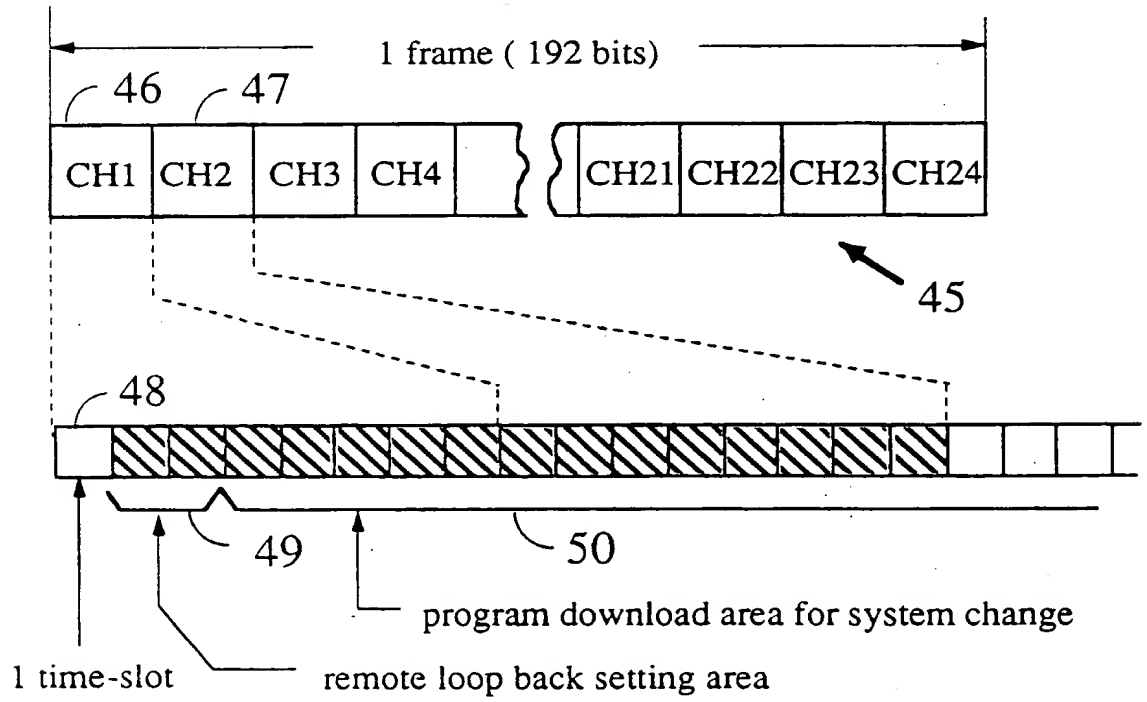
1 frame (192 bits)
46
47
CH1
CH2
CH3
CH4
CH21
CH22
CH23
CH24
45
48
49
50
program download area for system change
1 time-slot
remote loop back setting area

FIG. 6

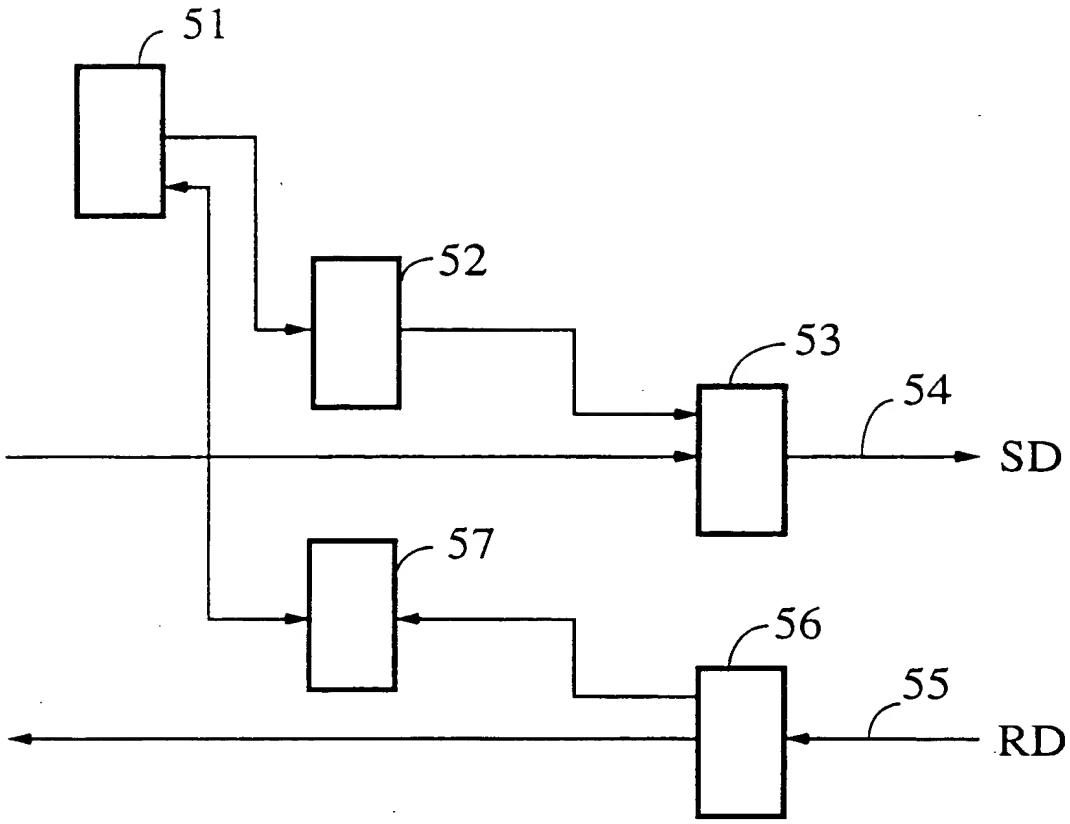
51
52
53
54
SD
57
56
55
RD

FIG. 7

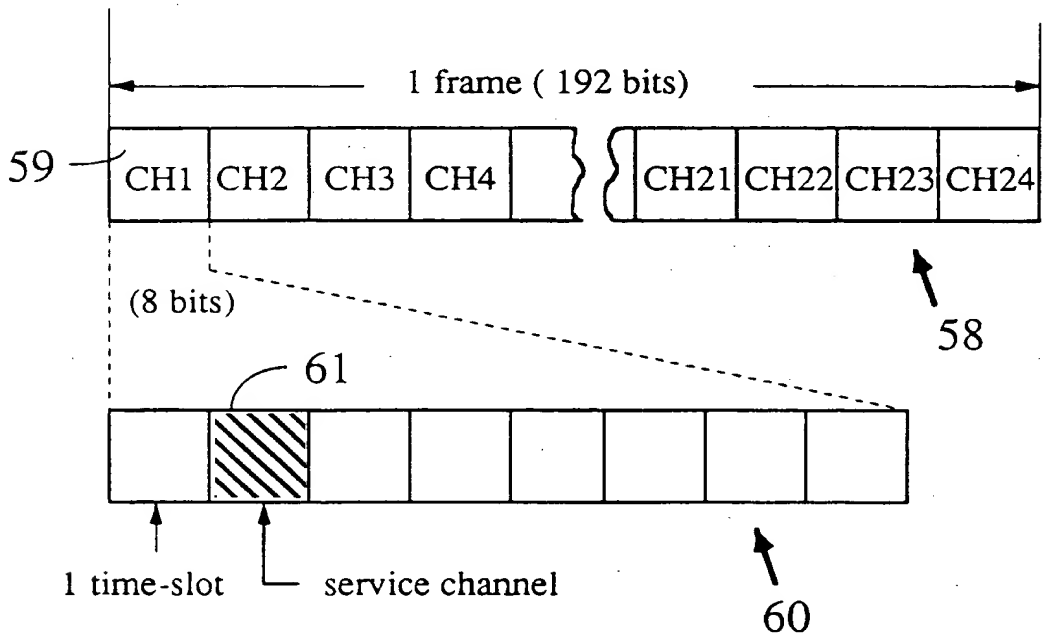
1 frame (192 bits)
59
CH1
CH2
CH3
CH4
CH21
CH22
CH23
CH24
(8 bits)
58
61
1 time-slot
service channel
60

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 12 1175

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB-A-2 143 706 (GENERAL DATACOMM INDUSTRIES INC.) * page 1, line 45 - line 59 * * page 2, line 39 * * page 3, line 31 - line 53 * * page 6, line 13 - line 19 *	1	H04J3/12
X	US-A-3 705 267 (PATRICK JOHN MARINO) * column 3, line 7 - line 47 *	1	
X	US-A-4 149 038 (SATYAN G. PITRODA ET AL.) * column 2, line 25 - line 36 * * column 2, line 58 - line 63 *	1,2	
A	US-A-4 059 729 (WESLY L. EDDY ET AL.) * column 2, line 16 - line 21 * * column 2, line 35 - column 3, line 15 *	2	
A	US-A-4 858 224 (YUKIO NAKANO ET AL.) * column 4, line 20 - line 39 *	2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) H04J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 FEBRUARY 1993	VAN DEN BERG J.G.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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